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AGRICULTURAL NEWS LETTER

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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations of the du Pont Company and its subsidiary companies. It also contains published reports and direct contributions of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.



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AGRICULTURAL NEWS LETTER

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"STATEMENT OF L. F. LIVINGSTON, MANAGER AGRICULTURAL
EXTENSION DIVISION, BEFORE THE SUB-COMMITTEE ON
FARM CHEMURGY, OF THE AGRICULTURAL STUDY COMMITTEE
OF THE HOUSE OF REPRESENTATIVES, WASHINGTON, D. C.,
WEDNESDAY, JANUARY 10, 1940".

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Gentlemen:

I am primarily an agricultural engineer, having been on the Agricultural Engineering Faculty of the University of Wisconsin before the World War, and at Michigan State College for 8 years following the World War. I have also had the honor of serving as President of the American Society of Agricultural Engineers. For the past 10 years, I have directed agricultural educational work for the du Pont Company in agricultural explosives and other lines of endeavor. I am a member of the Committee on Agricultural Cooperation of the National Association of Manufacturers, and a Director of the American Forestry Association.

Your Chairman, in his invitation, states that it is desired that scientists, industrialists, public men and educators appear before this Sub-committee on Farm Chemurgy to express their views as to the present accomplishments and the possibilities of the future of Farm Chemurgy. I am happy to be included in this group.

Farm Chemurgy I define as the industrial use of agricultural products. There is no question but that this field has great possibilities. There is, of course, question as to how fast the industrial type of outlet for agricultural products can be developed. The accomplishments that have been achieved to date have been outstanding, but it should be pointed out here that, until now, it has been industry and not agriculture which has carried the main burden of developing industrial applications for agricultural commodities.

With the heavy and, to a degree, punitive taxes now levied in this country, the incentive for the individual or industry to embark on venturesome and pioneering enterprise is in considerable measure inhibited. Financial failure in an endeavor places the loss on the individual alone; the achievement of major success results that too much of the reward is taken away from the developer of the enterprise in the form of taxes. The scales, with risk on one side and return on the other, are loaded today to the disadvantage of the forward-looking business man and engineer. The scientist with his new inventions, new processes and new products cannot help but encounter this hesitation for the support of new developments.

Industry to date has been in a large way responsible for the successful developments achieved in Farm Chemurgy, but industry, at this time, cannot afford

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or justify for itself the large expenses involved in a long-range, fundamental research program in this field. Therefore, if this is to be done, it must become essentially a job for the producers of agricultural commodities.

In the chemical industry, when it concerns finding outlets and uses for a new product, or increased uses for an existing product for which, for example, through improvements in process or economy of manufacture, the costs may have been greatly cheapened, it is the burden of the producer of that product to bend his efforts to finding the increased uses and outlets. The producer does not stand back waiting for the consumer and customer to come to him. He goes ahead and develops uses; he cooperates actively with whomever he foresees as a potential customer to demonstrate how that potential customer can more effectively apply the products in question; and that means demonstrating how his customer can achieve economies and improve quality for that customer's own goods. Agriculture is faced with the same thing, and its problem is to find more economical materials and better materials to offer to industry.

This can only be accomplished by research directed to improve existing agricultural materials, to lower the cost of production by improved crop methods and handling, to find new agricultural products more suited to industrial needs than those now available, and to demonstrate that the properties of these new agricultural products, or more cheaply available existing products, have advantages that demonstrate their utility and economy to industry. Experience shows that this can only be accomplished through coordinated and well-directed research.

The du Pont Company uses products from the farm amounting to approximately 220,000,000 lbs. annually. This volume was developed through years of chemical research. The du Pont Company spends approximately \$7,000,000 annually on research. This varies between 2% and 4% of the Company's gross revenue from sales.

The chemical industry, as a whole, spends 2% of its gross revenue on research. All manufacturing industry spends about 1/2 of 1% of its gross revenue on research. Agriculture, including all funds spent by the Federal Government, and all funds spent by the State Experiment Stations, including the money going into the four regional research laboratories, and including the small amount of work being done by groups interested in agricultural development, makes up a fund spent on research in agriculture, which amounts to only 1/7 of 1% of the value of agricultural products in the United States.

In other words, to put agriculture on a par with manufacturing industry as far as research goes, 3-1/2 times as much money should be spent on research work along agricultural lines.

One of the wisest moves, in my opinion, that has been made for a long time was the development which has now taken place is that four regional laboratories will work on the industrial uses of surplus agricultural crops. This type of work, in my opinion, should have your continued and hearty support. May I caution you, however, not to expect results too soon. The record of the du Pont Company, may be of interest. Our experience of nearly 40 years with

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organized research shows that from 6 to 10 years on an average is required from the time a research project is started in the laboratory until a product is put on the market. The time may be shorter, but more often it is longer.

The very fact that research work requires a long time to produce results is one of the most important reasons why it is so difficult to obtain adequate funds for this type of work, and because the best and the most fundamental research work is not spectacular, it is the easiest to abolish when those in charge are required to pare expenses.

We, in the du Pont Company have proved definitely that research work pays dividends. Mr. Lamont du Pont made a significant statement when he said that 40% of du Pont's present revenue from sales is derived from articles which were non-existent or which have been improved beyond recognition since 1928.

While I assume that you gentlemen on this Sub-Committee are most anxious to get immediate results which will benefit agriculture, I would like to emphasize that adequate continued research funds along the lines of industrial use of agricultural products, not limited to surplus products alone, but applying to anything that is grown on the farm, or may be grown on the farm, will have over a period of time more lasting benefit to agriculture than anything with which we are now familiar.

I have great respect for the research work which has been carried on for years by the United States Department of Agriculture, and the State Experiment Stations. They have literally made two blades of grass grow where one grew before; they have made it possible to pick two apples where only one was picked before. That was their job, and they did it well. In the past few years, more and more consideration is being given to what should be done with the extra blade of grass and the second apple, and this work will, if sufficiently supported, bring as good results as that which has gone before.

As I stated a while ago, the du Pont Company makes a great many articles from agricultural raw materials. These raw materials include cotton and wood pulp; products from corn, various vegetable oils, turpentine and rosin.

From cotton and wood pulp, we obtain cellulose which, as you know, is the fibrous material in all plant life, and from cellulose, we make a host of articles, including:-

- "Cellophane" cellulose film
- "Duco" finishes
- Motion-picture and X-ray films
- Rayon
- "Pyralin" and "Plastacele" plastics
- "Fabrikoid" pyroxylin-coated fabric
- Sporting Powders
- Cellulose Sponges
- "Cel-O-Seal" cellulose seals
- "Tontine" washable window shades.

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From corn products, we derive materials that are used in a large way in lacquers and in commercial explosives.

From turpentine and rosin, we make:-

Synthetic Camphor and derive components that are important ingredients used in combs, hair ornaments, hand bags, motion-picture film. Paints and varnishes.

From Vegetable Oils, we make fatty alcohols and also derive products used in "Dulux" finishes--paints, varnishes and enamels.

Dr. C. M. A. Stine, Vice President of the du Pont Company, has said that the field of cellulose chemistry is still in its infancy, although there are more than 10,000 commercial products using cellulose in one form or another. Cellulose, the fibrous material in all plant life, is obtainable from many sources, of which cotton and wood are the commercial ones at present because it is more economical to obtain it from those two sources.

As the field of cellulose chemistry is expanded, corresponding expansion of the uses of cellulose in industry will follow.

Agriculture can supply the cellulose in one form or another. Which form it supplies, whether cotton, corn stalks, wood, wheat straw or other form of plant life will depend eventually on which of these it finds most economical to produce.

Here again in fact is another emphasis on the need for research to determine this very point.

Although for years research workers have developed crops so that they will grow a large palatable stock, and a maximum amount of seed or grain, very little research work has been done with a view to developing a type and quality of cellulose producing stocks, or seed from the standpoint of its oil content.

I am not one of those who believe that through the Farm Chemurgic idea we can turn all farms into financial successes over night, but I do believe that if sufficient research work is done, great quantities of agricultural products will be used by industry. We all know that while there is a limit to the capacity of the human stomach, there is apparently no limit to the factory stomach.

Continued research is the best insurance for a continuing and expanded industrial utilization of farm products.

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PRELIMINARY REPORT OF WORK WITH "LORO" INSECTICIDE
FOR PACIFIC MITE ON APPLES

EDITOR'S NOTE: This progress report is offered to keep research workers informed about field work done with "Loro" during 1939. It should be borne in mind that this is only a progress report. The work will be continued during 1940.

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In May 1939, a survey of orchards was made in the Yakima Valley which had been heavily infested with the Pacific mite in 1938. The mites were found to be very scarce at the time of the examination, however, and spray tests were not then deemed of much value in determining the effectiveness of "Loro" insecticide as a control for this pest. Several growers expressed their intention of using "Loro" later in the season if the infestation justified, but the general inclination was to postpone any treatment until there was a threat of a serious outbreak. Because of the variable spray programs followed in codling moth control and the contradictory evidence in support of this or that method of mite control there was great confusion in the minds of growers as to the best method of handling the mite problem.

Early Treatment

It was reported there had been an extensive movement of mites upward from the soil during March and April. In one of the orchards visited which had suffered from heavy infestation in 1938 twenty-six trees had been sprayed with "Loro" 1:1000 on May 1. The treatment was repeated on May 18. This block offered a favorable opportunity of learning the value of an early treatment. Two months later--July 7--the number of mites per leaf on the treated block was 0.5 per leaf and on untreated trees 1.71 per leaf. In general appearance the untreated trees were as healthy looking as the treated ones. The effect of hot dry weather on the increase of mites was seen during July and August. Other factors in their increase were the longer intervals between the application of cover sprays, the suspension of cover sprays, and the heavy lead residues on the foliage. It was noted that abandoned unsprayed orchards were seldom infested. On August 8, because of the increase in abundance of mites, the owner found it advisable to apply a third "Loro" spray on the block of trees treated during May.

Another orchard was sprayed with "Loro" 1:1000 on June 21, before the mite infestation had reached a critical state. Very few mites could be found a week after spraying, but by the end of August the mite population had built up to 76 per leaf. All but one check tree from which the count was taken were resprayed on August 7th, the "Loro" dosage being increased to 1:800 for the second application. On September 5 the count of live mites on the sprayed trees was 5.8 per leaf while on the unsprayed check tree it was more than 100 per leaf.

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Critical Stage of Infestation

Infestations of Pacific mites do not seem to reach a critical stage until the population per leaf reaches about fifty. Below this number the mites do not produce a conspicuously visible injury to the foliage, but injury is made less apparent by the arsenical residues on the leaves. After the population reaches fifty per leaf even a week's time may bring on serious damage. The foliage becomes faded and rusty looking. The leaves are apt to drop off, especially in the center, of the tree, leaving many shoots naked. The fruit remains green or poor in color. The chief feature which distinguishes Pacific mite infestations, however, is the heavy webbing that occurs. Leaves and twigs are webbed. Around the calyx end of the apple, this webbing becomes a tight film resembling "Cellophane" cellulose film in lustre and transparency.

There is considerable evidence that when mites reach an average of forty or fifty per leaf, a remedial spray should be applied without delay. If this needs to be applied before July 15 the chances are strong that a second spray will be required in late August or early September.

"Loro" Concentration

The recommended dosage of "Loro" 1:1000 for apples was based on results secured in a few orchards treated at this concentration in the late season of 1938. According to the testimony of growers it appears that mites had already severely affected the foliage before the "Loro" spray was applied, and that numbers of the mites were in their orange colored migratory phase. The sprayed trees picked up rapidly after the treatment and the fruit attained a good color. This is evidence that the apple can sustain a large population of mites and still be able to recover when remedial measures are not taken until the peak of infestation is reached.

Of twelve apple and pear orchards that were sprayed in 1939 with "Loro" 1:1000 for Pacific mite, only three showed satisfactory control. The orchard, first sprayed with "Loro" 1:1000 on July 12 was treated again with "Loro" 1:1000 on July 27, and this also failed to control. There was an outstanding increase in the kill of Pacific mite when "Loro" 1:800 was applied. On July 17 a block of Anjou pears was sprayed with "Loro" 1:1000. Spraying was suspended when many live mites were found the next day; and the rest of the pears were sprayed at 1:800 on July 19. In a count taken on August 15 the block sprayed at 1:1000 gave a count of 84 per leaf, and the block treated at 1:800 gave a count of only 16.7 per leaf.

Of seventeen orchards that were treated for Pacific mite with "Loro" 1:800, none had to be resprayed, and control was good except in one or two cases, where there was evidence that the spray had been carelessly applied. A change in the recommended dosage, making it 1:800, instead of 1:1000, is therefore advised.

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"Loro" on Other Fruits

Prune orchards are often severely infested by rust mites, European red mite, and also by a mite first observed in the Yakima Valley in 1939, tentatively determined by Dr. E. A. McGregor as Eupolopsis mite. The latter mite and the rust mite were completely controlled by one application of "Loro" at 1:1066 (1 pint per 100 gallons water). If the pest involved is the European red mite or Bryobia mite, "Loro" at 1:800 can be safely used on prunes.

"Loro" was also applied on several varieties of pears (including Bartlett and Anjous) at 1:800 without causing any injury. Good control was obtained of rust mite and pear leaf blister mite with "Loro" 1:1000, and of European red mite at 1:800. Only one application was needed.

It was also demonstrated that "Loro" is safe to use on apricots and cherries, both of which are sometimes subject to the attack of Pacific mite.

Spreaders

It appears, from tests made in several orchards, that any of the spreaders accepted for use with lead arsenate sprays can satisfactorily be used with "Loro" according to their respective concentrations recommended by their manufacturers. The further addition of talc seemed to aid greatly in the dispersion of the spray and further tests in its use should be carried on next season.

"Loro" Generally Safe on Apples

"Loro" was used on apples at 1:800 when the temperature was 106°F. without producing any injury. The humidity at this temperature ranges from 18 to 20 in the Yakima Valley. Where the temperature and humidity are both high, "Loro" may cause severe foliage burn on apples which is not confined to any one variety. This was illustrated in one orchard sprayed on August 22 with "Loro" 1:800. This was an orchard of young trees having extremely low branches which laid against the damp ground and were buried in weeds. When the trees were sprayed the temperature was around 100°F. No burn was noted on branches which cleared the tops of the weeds, but there was very severe burn on the leaves of the low branches.

The safety of "Loro" on foliage is a function of the relative humidity as well as temperature and "Loro" can be safely applied to the types of foliage on which it is known to be safe when the sum of the relative humidity and the temperature expressed in degrees Fahrenheit does not exceed 140.

Under normal conditions all apples except Jonathan appear tolerant to "Loro" at 1:800. Some russeted areas occurred on fruit of Delicious which was sprayed twice with "Loro" 1:1000 during May, and it was the opinion of the grower it had been caused by too early an application when the apples were small and had very tender skins. About thirty per cent of the fruit on ten of twenty-six sprayed trees was affected.

No other cases of injury were noted in 1939 where apples had as many as two applications of "Loro" at 1:800. To summarize -- Many growers now feel that "Loro" is the best mite spray that has appeared but another season's work will be needed to further evaluate its merits. The work will be continued in 1940.

NORTH CAROLINA TESTS DEMONSTRATE
EFFICIENCY OF UREA NITROGEN IN TOBACCO FERTILIZERS

By O. F. Jensen
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E. I. du Pont de Nemours & Company, (Inc.)
Wilmington, Delaware

The North Carolina Agricultural Extension Service conducted eight tobacco fertilizer demonstrations in 1938 and again in 1939, all under the supervision of L. T. Weeks, Tobacco Specialist. The demonstrations included a comparison of the following tobacco fertilizers when used at the rate of 1,000 pounds per acre.

| <u>No.</u> | <u>Fertilizer</u> | <u>Source of Nitrogen</u> |
|------------|-------------------|---|
| 1 | 3-10-6 | 1/3 sodium nitrate, 1/3 ammonium sulfate, 1/6 cottonseed meal, 1/6 dried blood. |
| 2 | 3-10-6 | Same as No. 1, but one-half of the phosphate from mono-calcium phosphate |
| 3 | 3-10-6 | 1/3 sodium nitrate, 1/3 ammonium sulfate, 1/3 "Uramon"* |
| 4 | 3-10-6 | 2/3 Cal-Nitro, 1/3 "Uramon" |

With the exception noted, No. 2, all phosphate was derived from superphosphate. The potash in all fertilizers was derived from two units of muriate and four units of sulfate of potash. In the tests the tobacco was graded and weighed after curing. Similar grades from all plots were combined for sale. The value of the tobacco from each plot was then determined.

The results secured with fertilizers 1 and 3 give the most direct comparison of the efficiency of urea nitrogen, "Uramon", and a mixture of cottonseed meal and dried blood. Fertilizers 1 and 2 have one-third of the nitrogen derived from water-insoluble materials. Fertilizer 3 and 4 have all of the nitrogen derived from water-soluble sources. A comparison of these two groups will, therefore, afford further evidence of the efficiency of urea and water-insoluble sources of nitrogen. This, of course, involves the assumption that (a) the substitution of mono-calcium phosphate for one-half of the superphosphate in No. 2, and (b) the use of Cal-Nitro instead of sodium nitrate and ammonium sulfate in No. 4, did not materially alter the results.

*"Uramon" fertilizer compound is a trade-mark registered in U. S. Patent Office by E. I. du Pont de Nemours & Company, Wilmington, Del. "Uramon" contains 42 per cent urea nitrogen.

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Yield of Tobacco

The average yield of tobacco secured in tests on both Coastal Plain and Piedmont soils are given in table 1.

Table 1

Yield of Tobacco as Influenced by Substituting
"Uramon" for Cottonseed Meal and Dried Blood in a 3-10-6 Fertilizer

| Year | Yield, pounds per acre | | | |
|----------------------------|------------------------|--------------|--------------|-----------|
| | No. 1 | No. 2 | No. 3 | No. 4 |
| | Sod. nitrate | Sod. nitrate | Sod. nitrate | |
| | Amm. sulfate | Amm. sulfate | Amm. sulfate | Cal-Nitro |
| | C. S. Meal | C. S. Meal | "Uramon" | "Uramon" |
| | Blood | Blood (1) | | |
| Coastal Plain Tests | | | | |
| 1938 (3 tests) | 1098 | 983 | 1061 | 1106 |
| 1939 (4 tests) | 1238 | 1258 | 1341 | 1314 |
| Average (7 tests) | 1178 | 1140 | 1221 | 1225 |
| Piedmont Tests | | | | |
| 1938 (5 tests) | 997 | 1048 | 993 | 952 |
| 1939 (4 tests) | 1025 | 1049 | 1025 | 971 |
| Average (9 tests) | 1009 | 1048 | 1007 | 960 |
| Average All Tests | | | | |
| 1938 (8 tests) | 1035 | 1024 | 1019 | 1010 |
| 1939 (8 tests) | 1132 | 1154 | 1183 | 1143 |
| Average (16 tests) | 1084 | 1089 | 1101 | 1077 |

(1) One-half P_2O_5 from mono-calcium phosphate

In the demonstrations on Coastal Plain soils, the two fertilizers containing "Uramon" produced the highest average yields. They averaged 1223 pounds per acre as compared to 1159 pounds for the two fertilizers containing natural organics.

On the Piedmont soils, fertilizers 1 and 3 produced practically identical yields, 1009 and 1007 pounds. The Cal-Nitro--"Uramon" plot, No. 4, was relatively low, producing an average of 960 pounds. It may be noted that it was

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the low-yielding plot on the Piedmont soils in both 1938 and 1939. The soluble sources of nitrogen average 984 pounds of tobacco per acre as compared to 1027 from the plots receiving water-insoluble nitrogen in the fertilizer.

The average yields from all demonstrations are given in the bottom section of table 1, and show only small differences. In 1938, plots 1 and 2 produced the highest yields. In 1939, plot 3 made the highest yield. It was also the high-yielding plot for the two-year period. The two fertilizers with all water-soluble nitrogen produced an average yield of 1089 pounds as compared to 1087 for the plots receiving one-third of the nitrogen from insoluble organics. This difference is much too small to be considered significant. It is apparent, however, that low cost urea nitrogen is just as efficient as the higher-priced water-insoluble organics.

Value of Tobacco

The value of the tobacco produced by the five fertilizer treatments is shown in table 2. On the Coastal plain soils, the highest average values, like the average yields, were produced with the fertilizers containing "Uramon" instead of insoluble organics. The two plots receiving only soluble nitrogen produced tobacco valued at \$230.96, whereas that from the two plots receiving insoluble nitrogen averaged \$224.06.

Table 2

Value of Tobacco as Influenced by Substituting "Uramon"
for Cottonseed Meal and Dried Blood in a 3-10-6 Fertilizer

| Year | Value, dollars per acre | | | |
|---------------------|-------------------------|--------------|--------------|-----------|
| | No. 1 | No. 2 | No. 3 | No. 4 |
| | Sod. nitrate | Sod. nitrate | Sod. nitrate | |
| | Amm. sulfate | Amm. sulfate | Amm. sulfate | Cal-nitro |
| | C. S. Meal | C. S. Meal | "Uramon" | "Uramon" |
| | Blood | Blood (1) | | |
| <hr/> | | | | |
| Coastal Plain Tests | | | | |
| 1938 (3 tests) | : 240.56 | : 222.25 | : 231.97 | : 247.29 |
| 1939 (4 tests) | : 216.66 | : 220.45 | : 230.58 | : 218.33 |
| Average (7 tests): | 226.90 | : 221.22 | : 231.18 | : 230.74 |
| <hr/> | | | | |
| Piedmont Tests | | | | |
| 1938 (5 tests) | : 269.09 | : 282.02 | : 261.98 | : 252.33 |
| 1939 (4 tests) | : 156.85 | : 159.08 | : 156.93 | : 142.24 |
| Average (9 tests): | 219.21 | : 227.38 | : 215.29 | : 203.07 |
| <hr/> | | | | |
| Average All Tests | | | | |
| 1938 (8 tests) | : 258.39 | : 259.61 | : 250.73 | : 250.44 |
| 1939 (8 tests) | : 186.76 | : 189.77 | : 193.76 | : 180.29 |
| Average (16 tests): | 222.58 | : 224.69 | : 222.25 | : 215.37 |

(1) One-half P₂O₅ from mono-calcium phosphate

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On Piedmont soils the highest valued tobacco was produced on plot 2 and the lowest value was secured from plot 4. The two plots with one-third insoluble nitrogen averaged \$223.30 per acre as compared to \$209.18 from the plots with all nitrogen from soluble sources. This difference is probably no more significant than that secured on the Coastal Plain soils.

The average of all data shows no consistent or significant differences. For example fertilizers 1 and 3, differing only by the substitution of "Uramon" for cottonseed meal and blood, produced crop values of \$222.58 and \$222.25 respectively. The soluble nitrogen plots averaged \$218.91 and the plots receiving some insoluble nitrogen averaged \$223.64. The results on crop values, like those for crop yield, indicate urea nitrogen may safely be substituted for the more expensive organics in tobacco fertilizers.

Discussion

The results obtained in these tests demonstrate the efficiency of urea nitrogen in tobacco fertilizers. That urea nitrogen may be substituted for natural organics without reducing yields of tobacco and other crops has been demonstrated in many tests and experiments. These results might be anticipated from a comparison of the properties of urea nitrogen and that derived from high-grade natural organics such as cottonseed meal. The following tabulation summarizes the properties of the two sources of nitrogen.

| | <u>Urea Nitrogen</u> | <u>Cottonseed Meal Nitrogen</u> |
|-------------------------------------|----------------------|---------------------------------|
| Availability to the crop | Very high | High |
| Rate of decomposition in soil | Very rapid | Rapid |
| Losses by leaching from soil | Slight | Very slight |
| Initial effect on soil reaction | Basic | Basic |
| Residual effect on soil reaction | Slightly acid | Slightly acid |
| Chemical nature | Organic | Organic |
| Solubility in water | Soluble | Insoluble |

This summary of properties shows the two sources of nitrogen have very similar properties and, therefore, should give similar results when used as a source of nitrogen in fertilizers. The only important difference in properties is their solubility in water. This seems relatively unimportant since urea nitrogen forms water-insoluble compounds with the soil soon after it is applied in the field.

UREA AS A SOURCE OF NITROGEN FOR POTATOES
 IN THE HASTINGS, FLORIDA, AREA

EDITOR'S NOTE: The following is an abstract of results of a series of experiments reported by B. W. Hundertmark and R. V. Allison, Florida Agricultural Experiment Station, in "The American Potato Journal," Vol. 16, 322-29 (December) 1939.

The Florida Agricultural Experiment Station cooperating with the Hastings Potato Growers Association and several growers conducted potato fertilizer experiments in 1937, 1938, and 1939. The objectives were to determine: (1) whether urea nitrogen could be used instead of natural organics; (2) whether there was any advantage in including nitrate nitrogen in the formula, and (3) the response of potatoes to supplements of minor elements, copper, zinc, manganese, and boron.

All but one of the fourteen experiments were on Bladen fine sand or Bladen fine sandy loam. Fertilization was with one ton of 5-7-6 per acre. The sources of nitrogen used in the different fertilizers are shown in the accompanying table. All fertilizers contained the same amounts and sources of phosphate and potash and also contained 150 pounds dolomite per ton. They were applied by hand on 1/20 acre plots about 10 days in advance of planting. In most experiments the treatments were replicated three or four times. Harvest records were taken from 1/40 acre plots. All culture operations were those common to the area.

The results are summarized in the following table. In this table the yields from the plots receiving the supplements of minor elements are averaged with the other plots because in no instance was there a difference due to supplements.

| Fertilizer Treatment (2000 pounds 5-7-6 per acre) | Average Acre Yields, No. 1 Tubers | | | |
|---|-----------------------------------|--------------|--------------|--------------|
| | 1936-1937 | 1937-1938 | 1938-1939 | Weighted |
| | 48 | 34 | 12 | Averages |
| | Replications | Replications | Replications | Replications |
| No. 1 | bushels | bushels | bushels | bushels |
| 50% Insoluble organic | : | : | : | : |
| 15% Nitrate of soda | 135.4 | 171.5 | 134.1 | 148.1 |
| 35% Sulfate of ammonia | : | : | : | : |
| No. 2 | : | : | : | : |
| 50% Urea | : | : | : | : |
| 15% Nitrate of soda | 133.1 | 173.7 | 135.8 | 148.1 |
| 35% Sulfate of ammonia | : | : | : | : |
| No. 3 | : | : | : | : |
| 50% Urea | 145.8 | 161.6 | 131.1 | 149.3 |
| 50% Sulfate of ammonia | : | : | : | : |
| No. 4 | : | : | : | : |
| 20% Insoluble organic | : | : | : | : |
| 40% Urea | 136.1 | 168.0 | 131.7 | 147.2 |
| 40% Sulfate of ammonia | : | : | : | : |

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The results show that urea may be substituted for the high-priced natural organics in the potato fertilizer without adversely affecting yields. There was no advantage in deriving one-fifth or one-half of the nitrogen from insoluble organics nor was there any advantage in including nitrate nitrogen in the mixture. The authors summarize their conclusions as follows:

"The results of these tests point to a definite saving that might be effected in fertilizer costs for potatoes in the Hastings area through a judicious use of urea as a partial source of nitrogen. The chief evidence for this conclusion is the complete support of yield which this material has shown together with the lower net cost per unit of nitrogen."

Reprints of the article may be obtained by addressing the Agricultural News Letter.

PREVENTING DISEASE IN TOBACCO SEEDBEDS

EDITOR'S NOTE: Because of the widespread outbreak of black rootrot this past season (1939), P. G. Newell, Dominion Laboratory of Plant Pathology, St. Catharines, Ontario, urges all tobacco growers "to practice the effective measures which will definitely prevent diseases of the seedbeds in the future." In a press release issued by the Extension Division of the Department of Agriculture, Ottawa, Canada he offers suggestions, which are summarized in the following article.

As soon as replanting is completed, pull, dry, and burn all plants remaining in seedbed.

Also burn discarded plants. Never spread old seedbed soil over tobacco land or where it will blow or wash onto tobacco land.

Before the seed is sown, steam the soil in seedbed thoroughly.

This will kill disease-producing organisms, including black rootrot and damping-off fungi. It will also kill weed seeds and increase the fertility of the soil. A good job of steaming results when:

Soil is in proper condition before steaming. The frost must be entirely out of the soil. The soil and muck should be sufficiently moist so that it will only just keep the mould of the hand when squeezed. Work the soil up to permit good drainage and even penetration of the steam.

Soil temperature is maintained for 30 minutes at not less than 180 degrees F. at a depth of six inches. This necessitates a continuous flow of steam into the pan for not less than 30 minutes. With high-pressure boilers, sufficient capacity is needed to furnish a continuous flow of steam to the pan at a minimum pressure of 90 to 100 pounds. (Check steaming job with a reliable thermometer. A good dairy thermometer will do.)

Side-walls, boards, and poles are sprinkled heavily with a formaldehyde* solution (1 gallon to 25 gallons of water). This treatment is especially important in beds in which there has been loss from disease the previous season.

*Any treatment with formaldehyde should be done 7 to 10 days before seeding.

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Parts of beds which cannot be steamed should be worked up. This soil and walks should be drenched with a formaldehyde* solution (1 gallon to 50 gallons of water). Use $\frac{1}{2}$ to 1 gallon per square foot. Place papers or fertilizer sacks soaked in this mixture over these areas for at least 48 hours to retain formaldehyde fumes.

After steaming, do not walk on bed until after all the plants are out in the field.

This is a precautionary measure to avoid taking disease-producing organisms into the bed again.

Water early in the day so that the plants can go into the night dry.

Care in watering and plenty of ventilation are important measures in checking the development of seedbed diseases.

Disinfection of seed is worthwhile precautionary measure.

Place the seed in cheesecloth bags and soak in a solution of 1 part silver nitrate (14 Grs.) to 1000 parts of water (1 qt.) for 15 minutes. Wash the bags of seed immediately in several changes of fresh water and then spread out to dry.

Do not transplant diseased plants.

Growers cannot be warned too strongly against transplanting diseased plants, because such a practice results in the transfer of tobacco parasites into the field, where they may attack healthy tobacco planted there another year.

*Any treatment with formaldehyde should be done 7 to 10 days before seeding.

"CELLOPHANE" USED TO SOLVE
POTATO PACKAGING PROBLEM

EDITOR'S NOTE: The marketing of agricultural products is constantly gaining in importance. Any research work bearing on this subject should have consideration.

Shippers of Idaho potatoes are solving an acute packaging problem with bag top "windows" of "Cellophane" cellulose film. A sheet of "Cellophane" is placed over the potatoes and the bag open-laced across. The transparent film permits examination by buyers, at the same time preventing spillage.

Idaho potatoes of the type much desired for baking are sold largely on appearance. Size and skin texture determine salability and price.

F. L. Hansen, manager of the Idaho Falls Potato Growers Association was the first to weigh possibilities of the new bag closure. Previously, potatoes were shipped in burlap bags roughly laced at the opening. Difficulties arose with bruised and scarred potatoes which invariably slipped out. This damage became so serious that legislation was enacted making it necessary to keep the potatoes covered. Removable cardboard shims have been used under the laces, but are not entirely satisfactory, it is said. Re-shipment after the board has been torn is often troublesome.

The new cellulose shim fits securely over the tubers, which are sacked in the usual type of open-mug bag, laced across the top. The trade mark is printed on the film. Potatoes are clearly visible. The first shipment making use of the window top was sent out recently and reported to have come up to expectations.

Mr. Hansen adopted the "Cellophane" closure after consultation with packaging experts of the du Pont Company. His organization ships 200,000 to 400,000 hundred-pound bags a year, approximately 10 per cent of the Idaho total.
